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EXAMINER

CHOW, CHARLES CHIANG

ART UNIT	PAPER NUMBER
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2618

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/531,231	Applicant(s) MANKU, TAJINDER	
	Examiner Charles Chow	Art Unit 2618	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 22 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 19-21 is/are allowed.
- 6) ☒ Claim(s) 1-3, 5-8 and 10-18 is/are rejected.
- 7) ☒ Claim(s) 4 and 9 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 April 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>2/22/2006</u> | 6) <input type="checkbox"/> Other: _____ |

Detailed Action

1. This office action is for Preliminary Amendment received on 4/13/2005, with claim 22 being canceled.

Title

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The current title, "DC trimming circuit for radio frequency (RF) down-conversion", is not clearly indicating the key features of the invention, for the delta current source trimming at the differential transconductance input cell of the mixer in cascading with another mixer, for reducing the IM2 & DC offset.

Drawing Objection

3. The drawings are objected to because there is no mixer-output being labeled on drawings for Fig. 5, Fig. 7, Fig. 10. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of

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any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objected

4. Claims 5, 11, 20 are objected to because of the following informalities:

In line 2 of claim 5, the "(P2" should be $\Phi 2$.

In line 2 of claim 11, the "LB" should be lb.

In line 14 of claim 20, the "A1" should be ΔI . For the examining purpose, the A1 is assumed to be ΔI .

For the above typographical errors, appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Durec (US 6,144,846) in view of Hong et al. (US 5,859,559).

For claim 1, Durec teaches a circuit for down-converting a differential input signal $x(t)$ [Fig. 3 to Fig. 5 & its description in specification; differential input, RFin at 48A/48B in Fig. 4; col. 5, lines 4-20] comprising

- a differential transconductance input cell [58, col. 7, lines 19-21, Fig. 4] consisting of separate positive and negative channels for receiving positive and negative channels of said input signal $x(t)$ [48A with 62/49A & 48B with 64/49B, Fig. 4], and
- amplifying said positive and negative channels of said input signal $x(t)$ [the differential separate, channel are formed by 62/49A & 64/49B provides the amplified signals at

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49A/49B, as the positive & negative channel outputs from transconductance 58, Fig. 4, col. 7, lines 29-32] ;

a first differential mixer [14A, Fig. 4] for receiving said amplified input signal $x(t)$ [49A/49B], and mixing said input signal $x(t)$ with a first mixing signal $\Phi 1$, to generate an output signal $\Phi 1 x(t)$ [mixer 14A mixing the amplified RFin signal with the local oscillator signal at 50A/50B, as first mixing signal $\Phi 1$, to generate mixer output signal (output of 30A)* RFin, at 51A/51B in Fig. 4, col. 6, lines 5-34; local oscillator signal at 50A/50B, as $\Phi 1$, is from 30A in Fig. 3; col. 5, line 36 to col. 6, line 4],

a second differential mixer [14B, Fig. 4] for receiving said signal $\Phi 1 x(t)$ as an input, and mixing said signal $\Phi 1 x(t)$ with a second mixing signal $\Phi 2$, to generate an output signal $\Phi 1 \Phi 2 x(t)$ [mixer 14B mixing the output signal from 14A at 51A/51B with the second local oscillator signal at 52A/52B, as the second mixing signal $\Phi 2$, to generate mixer output signal (output of 30B) * (output of 30A)* RFin at 53A/53B in Fig. 4, col. 6, lines 35-58; local oscillator signal at 52A/52B, as $\Phi 2$, is from 30B in Fig. 3; col. 5, line 36 to col. 6, line 4], any number of mixer circuit can be included [col. 5, lines 11-20].

Durec fails to clearly teach a pair of current sources I_a & I_b .

Hong teaches the a pair of current sources I_a and I_b [trickle currents 84, 85 from current mirror 82, Fig. 2, col. 3, lines 34-58] for providing current to respective outputs of said positive and negative channels of said differential transconductance input cell [col. 4 , to reduce the current drawn from said first differential mixer [trickle currents 84 & 85 are set by 66, to optimize the head room of collector currents 37/38, to enhance, improve, the third order intercept point/gain of the mixer 80, col. 4, lines 4-30],

said current sources I_a and I_b being trimmed in a complementary manner where $I_a = I + \Delta I$, and $I_b = I - \Delta I$ [the bias voltage at 66/98 selectively adjusts the trickle currents, col. 4, lines 4-

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30 & col. 3, lines 46-58; and current 116 is the sum of the current of 84 and 72, the same for 117 is the sum of 73 & 85 respectively, to provide constant current at 31/32, in a complementary differential structure, 72/116, 73/117, Fig. 2, col. 4, lines 4-14; the increasing of ΔI in 84 would compensate by a decreasing of ΔI in 85], in order to improve the third order intercept point via the trickle current from 82. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to improve Durec with Hong's trickle currents 84/85, in order to improve the third order intercept point via the trickle currents from 82.

{ Note: **Khorram US 6,801,761 B2**, in below, also teaches the gated current source controlled by 142, Fig. 6, to balancing with the $\pm \Delta I$ in col. 7, line 59 to col. 8, line 19, Fig. 6.

Khoury, US 5,532,637, teaches the different structure from applicant, the shared output at 19, 20 of the two mixers 33, 34 in Fig. 4 & its description in specification, having injection current sources 25, 26 for the input differential amplifiers 11, 12, to reduce the distortion by adjusting 25, 26; col. 4, line 13 to col. 5, line 13 }.

For claim 2, Durec teaches the circuit of claim 1 [Fig. 3 to Fig. 5 & its description in specification], but fails to teach the means for setting the level of ΔI .

Hong teaches the means for setting the level of ΔI [the bias voltage at 66/98 selectively adjusts the trickle currents, col. 4, lines 4-30 & col. 3, lines 46-58], to optimize the third order intercept point, using the same reasoning in claim 1 above to combine Hong to Durec.

6. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Durec in view of Hong, as applied to claim 1 above, and further in view of Zhou (US 2003/0216,128 A1) and Bergsma et al. (US 6,711,396 B1).

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For claim 3, Durec teaches the circuit of claim 1 [Fig. 3 to Fig. 5 & its description in specification, for providing output as $\Phi_1 \Phi_2 x(t)$], but fails to teach the reducing the IM2 & DC offset.

Zhou teaches the IM2 & DC offset is due to the mismatching, imbalancing, in the mixer circuit, which causes the IM2 & DC offset in the mixer [paragraph 0024, 0047], to improve the IM2 & DC offset of a mixer, via better matching, balancing, in the mixer circuit.

Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to improve Durec, Hong with Zhou's matching, balancing, to improve the IM2 & DC offset of a mixer by matching, balancing.

Zhou, Durec, Hong fail to teach the means for manipulating ΔI to reduce the IM2 & DC offset.

Bergsma teaches the means for manipulating ΔI to reduce the IM2 and DC offset from mixer output whereby matching parameters for said mixers can be relaxed [the compensator circuit to inject currents which can be adjusted via bias 1/bias 2, Fig. 11, col. 11, line 52 to col. 12, line 33 & col. 3, lines 18-46], to improve the mismatching in circuit branches, col. 2, lines 1-31], such that the IM2 & DC offset could be improved by adjusting the bias1/ bias 2 via a better matching in branches. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to improve Durec, Hong, Zhou with Bergsma's bias 1/bias 2 adjustment for current injecting, in order to improve the IM2 & DC offset.

7. Claims 5, 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Durec in view of Hong, as applied to claim 1 above, and further in view of Cowley et al. (US 6,937,670 B2).

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For claim 5, Durec teaches the circuit of claim 1 [Fig. 3 to Fig. 5 & its description in specification, & selecting $\Phi 1$, $\Phi 2$, via NselA & NselB to counter 30A/30B]. Durec & Hong fail to teach the demodulate said input signal to base band.

Cowley et al. [Cowley] teaches the wherein said first mixing signal $\Phi 1$ and said second mixing signal $\Phi 2$ are chosen to demodulate said input signal $x(t)$ to base band [the direct down conversion from 1 to base band at input of 8, figure in cover page, the local oscillator signals, from 3, 6 are chosen, as $\Phi 1$, $\Phi 2$, can be either 1.05 & 1.1-1.96 GHz or 1.15-1.96 & 1.1 GHz, col. 2, line 60 to col. 3, line 28], to reduce the interference signal in a direct down conversion [col. 4, lines 43-50]. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to upgrade Durec, Hong with Cowley's direct down conversion, such that the interference could be reduced.

For claim 8, Durec teaches the circuit of claim 1 [Fig. 3 to Fig. 5 & its description in specification, & selecting $\Phi 1$, $\Phi 2$, via NselA & NselB to counter 30A/30B]. Durec & Hong fail to teach the direct conversion.

Cowley teaches the where said first mixing signal $\Phi 1$ and said second mixing signal $\Phi 2$ are chosen to emulate a direct conversion local oscillator signal [the direct down conversion from 1 to base band at input of 8, figure in cover page, the local oscillator signals, from 3, 6 are chosen, as $\Phi 1$, $\Phi 2$, can be either 1.05 & 1.1-1.96 GHz or 1.15-1.96 & 1.1 GHz, col. 2, line 60 to col. 3, line 28],

where $\Phi 1 * \Phi 2$ has significant power at the frequency of said local oscillator signal being emulated, and neither of said $\Phi 1$ nor said $\Phi 2$ having significant power at the carrier frequency of said input signal $x(t)$ or said LO signal being emulated [the frequency of the local oscillator 3, & down converter 5-7, is always greater than the upper frequency of input

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signal, col. 3, lines 49-67], using the same reasoning in claim 5 above to combine Cowley to Durec & Hong.

8. Claims 6-7, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Durec in view of Hong, Zhou, Bergsma as applied to claim 3 above, and further in view of Gilmore (US 7,013,120 B2).

For claim 6, Durec teaches the circuit of claim 1 [Fig. 3 to Fig. 5 & its description in specification]. Durec & Hong fail to teach the claimed filter.

Gilmore teaches a filter electrically connected between said first mixer and said second mixer [high pass filter 812, 820, Fig. 8], in order to reject the image signal [col. 1, lines 7-9]. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Durec, Hong, Zhou & Bergsma with Gilmore's filter 812, in order to reject the image signal.

For claim 7, Durec teaches the circuit of claim 1 [Fig. 3 to Fig. 5 & its description in specification]. Durec & Hong fail to teach wherein said filter comprises a high pass filter.

Gilmore teaches the teach wherein said filter comprises a high pass filter [high pass filter 812, 820, Fig. 8], using the same reasoning in claim 6 above to combine Gilmore to Durec & Hong.

For claim 15, Durec teaches the circuit of claim 1 [Fig. 3 to Fig. 5 & its description in specification].

Hong teaches a resistor dividing network for setting the common mode voltage output [the resistor network 444/420, 464/422 provide the feedback from output 413/ 415, Fig. 4, to adjust the level shifting to reduce the IM2 & DCoffset, abstract, paragraph 0027-0030, 0059-0060, 0067-0068], in order to reduce the IM2 & Dc offset. Therefore, it would have been

obvious to one of ordinary skill in the art at the time the invention was made to modify Durec with Hong's output feedback via resistors to network 400, in order to reduce the IM2 & DC offset.

Durec & Hong fail to teach a high pass filter in between mixers.

Gilmore teaches the teach wherein said filter comprises a high pass filter [high pass filter 812, 820, Fig. 8], in order to reject image signal, using the same reasoning in claim 6 above to combine Gilmore to Durec & Hong.

9. Claims 10, 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Durec in view of Hong, as applied to claim 1 above, and further in view of Khorram (US 6,801,761 B2).

For claim 10, Durec teaches the circuit of claim 1 [Fig. 3 to Fig. 5 & its description in specification], Hong teaches the current sources 84/85.

Durec, Hong fail to teach the switchable transistors to vary the current supplied.

Khorram teaches the wherein of said current sources 1a and 1b [gated current source 170/180/182 for 1a & 172/184/186 for 1b] comprises a plurality of switchable transistors [plural of switches, in Fig. 7, which are controlled by 142 from processors 64/67 for the compensator module 134, col. 8, lines 20-36], each with different performance parameters [to control the gain or impedance, col. 7, lines 41-45]; and

circuit further comprises a means for switching the various transistors in and out of the circuit to vary the current supplied [the control signal 142 from processors 64/67 controls the gated current source in & out, of the mixer circuit, to balance current with $\pm \Delta I$, col. 7, lines 32-45 & col. 7, lines 59 to col. 8, line 19], in order to closely match the operational characteristics of the mixers, to reduce the interference from local oscillator leakage [col. 3,

lines 20-25]. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Durec, Hong with Khorram's compensator with plurality of switching current sources, in order to reduce the interference from local oscillator leakage.

For claim 12, Durec, Hong & Khorram teach the circuit of claim 10 above. Durec also teaches the wherein said first mixer comprises an active mixer [the active mixer 14A as shown in Fig. 4].

For claim 13, Durec, Hong fail to teach the circuit in claim 12 which has the switchable current, together with the wherein said first mixer comprises an active mixer having adjustable performance..

Khorram teaches the wherein said first mixer comprises an active mixer having adjustable performance [the switching of the plural of current source to improve the mixer performance by reducing the interference from local oscillator leakage, col. 7, lines 32-45 & col. 7, lines 59 to col. 8, line 19; col. 3, lines 20-25], using the same reasoning in claim 12 above to combine Korram to Durec, Hong.

10. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Durec in view of Hong, as applied to claim 1 above, and further in view of Zhou-'128 A1.

For claim 11, Durec, Hong teaches the circuit in claim 1 above.

Hong teaches the current source 84, 85, for current Ia & Ib, but fail to teach the modulated signal using a common mode feedback circuit.

Zhou teaches the modulated signal using a common mode feedback circuit [the feedback from mixer output 413/415 via resistors 444, 464, to modulate the current at transistors 432, 452, Fig. 4 & paragraph 0059-0060, 0067-0068], to reduce the IM2 & DC

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offset [abstract]. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Durec, Hong with Zhou's feedback from mixer output, in order to reduce the IM2 & DC offset.

11. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Durec in view of Hong, as applied to claim 1 above, and further in view of Lee et al. (US 2005/0087,813 A1).

For claim 14, Durec teaches the circuit in claim 1 above. Durec & Hong fail to teach the wherein said second mixer comprises a passive mixer.

Lee et al. teaches the wherein said second mixer comprises a passive mixer [passive mixer 1107, Fig. 11, paragraph 0068-0069], in order to control the i/f noise [abstract], & to reduce the power consumption. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Durec, Hong with Lee's second passive mixer, in order to control the i/f noise & reduce the power consumption.

12. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Durec in view of Hong, Cowley, as applied to claim 5 above, and further in view of Laws (US 5,303,417).

For claim 16, Durec teaches the circuit [Fig. 3/Fig. 5]. Durec, Hong, Cowley fail to teach the wherein said first mixing signal and said second mixing signal are generated by a voltage-controlled oscillator.

Laws teaches the wherein said first mixing signal and said second mixing signal are generated by a voltage-controlled oscillator [the LO vco in Fig. 5 for generating local oscillator signal for mixer Mix1I & Mix2I, for the direction conversion, col. 3, lines 44-55] to reduce the circuitry by using a single voltage controlled oscillator VCO. Therefore, It would

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have been obvious to one of ordinary skill in the art at the time the invention was made to modify Durec, Hong, Cowley with Laws single VCO, in order to reduce the circuitry.

For claim 17, Durec teaches the circuit [Fig. 3/Fig. 5]. Durec & Hong, Cowley fail to teach the VCO is tuned to a multiple of the carrier frequency.

Laws teaches the wherein said voltage-controlled oscillator is tuned to a multiple of the carrier frequency of said input signal $x(t)$ [the LO frequency is tuned to the two times of the input rf frequency, col. 3, lines 44-55], using the same reasoning in claim 16 above to combine Laws to Durec, Hong & Cowley.

13. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Durec in view of Hong, Cowley, Laws, as applied to claim 16 above and further in view of Kazakevich (US 2001/0041,546 A1).

For claim 18, Durec teaches the circuit [Fig. 3/Fig. 5]. Durec & Hong, Cowley fail to teach the wherein said voltage-controlled oscillator is tuned to a divisor of the carrier frequency of said input signal $x(t)$.

Kazakevich teaches the wherein said voltage-controlled oscillator is tuned to a divisor of the carrier frequency of said input signal $x(t)$ [the local oscillator 11 tuned to half of the input carrier frequency, by a divider factor of 2, Fig. 1, paragraph 0012], in order to reduce the interference from the local oscillator LO leakage [paragraph 0002, 0007]. Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Durec, Hong, Cowley with Kazakevich's tuning of local oscillator to half of the input carrier frequency, in order to reduce the interference from the local oscillator LO leakage.

Claims Objection

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14. Claims 4, 9 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior arts fail to teach the wherein ΔI is determined during a two-tone test as the current level which minimized IM2 output at base band in claim 4.

The prior arts fail to teach the where said first mixing signal $\Phi 1$ is a multi-tonal signal, and said second mixing signal $\Phi 2$ is a monotonal signal in claim 9, after considered four references in the claim 6 which claim 9 is depending upon, for the multi-tonal signal having more than one fundamental frequency tone & the mono-tonal signal having one fundamental frequency tone.

Allowable Subject Matter

15. The following is an examiner's statement of reasons for allowance:

Claims 19-21 are allowable over the prior art of record. The prior arts fail to teach the allowable features, singly, particularly, or in combination.

The prior arts fail to teach the features in **claim 19**, for the said method comprising the step of injecting a two-tone signal at said input;
measuring IM2 at the baseband output of said circuit;
determining the level of ΔI which minimizes IM2;
recording the level of ΔI which minimizes IM2; and
using said recorded level of ΔI during normal operation of said down-converter.

The prior arts fail to teach the features in **claim 20**, for the wherein ΔI can be manipulated to reduce the IM2 and DC offset in the output signal $\Phi 1 \Phi 2 x(t)$, and wherein matching parameters for said mixers can be relaxed.

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The dependent **claim 21** is also allowable due to their dependency upon the allowable independent claims above, and the having additional claimed features.

The closest prior art **Durec (US 6,144,846)** teaches the compound mixer in series for the down conversion [Fig. 1-5 & its description in specification], with the frequency of local oscillator signal substantially different from the frequency of rf input [col. 1, lines 36-41], to prevent LO pulling, pushing [col. 1, lines 29-33], but fail to teach the steps of injecting a two-tone signal at said input; measuring IM2 at the baseband output of said circuit; determining the level of ΔI which minimizes IM2; recording the level of ΔI which minimizes IM2; and using said recorded level of ΔI during normal operation of said down-converter.

The prior art **Khoury et al. (5,532,637)** teaches in Fig. 4 & its description in specification, the shared output 19, 20 from mixers 33, 34, having injection current sources 25, 26 for the input differential amplifiers 11, 12, to reduce the distortion by adjusting 25, 26 [col. 4, line 13 to col. 5, line 13], but fails to teach the features which missed by Durec.

Other prior arts in below has been considered, but they fail to teach the above allowable features.

Souetinov et al. (US 6,308,058 B1) teaches in Fig. 2 & its description in specification, the mixers 294, 295 having input differential 290 with adjustable biasing voltage at 260-262 to cancel the second harmonic [abstract].

Hong et al. (US 5,859,559) teaches trickle current injection 84, 85 to transconductance input cell to improve the third order intercept point [Fig. 2, abstract, col. 4, lines 4-30].

Bergsma et al. (US 6,711,396 B1) teaches the compensator circuit to inject currents which can be adjusted via bias 1/bias 2 [Fig. 11, col. 11, line 52 to col. 12, line 33 & col. 3, lines 18-46], to improve the mismatching in circuit branches [col. 2, lines 1-31].

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Zhou (US 2003/0216,128A1) teaches the IM2 & DC offset is due to the mismatching, imbalancing, in the mixer circuit, which causes the IM2 & DC offset in the mixer [paragraph 0024, 0047], to improve the IM2 & DC offset of a mixer via better matching, balancing, in the mixer circuit.

Gilmore (US 7,013,120B2) teaches the high pass filter 812, 820 between two mixers, [Fig. 8].

Khorram (US 6,801,761B2) teaches the gated current source controlled by 142, Fig. 6, to balancing with the $\pm \Delta I$ in [col. 7, line 59 to col. 8, line 19, Fig. 6].

Laws (US 5,303,417) teaches the LO vco in Fig. 5 for generating local oscillator signal for mixer Mix1I & Mix2I, for the direction conversion [col. 3, lines 44-55].

Kazakevich (US 2001/0041,546 A1) teaches the local oscillator 11 tuned to half of the input carrier frequency, by a divider factor of 2 [Fig. 1, paragraph 0012], in order to reduce the interference from the local oscillator LO leakage [paragraph 0002, 0007].

Other prior arts are also considered. They are **Cowley (US 6,714,263)**, **Tanabe et al. (US 4,461,042)**, **Peterov et al. (US 7,139,546)**, **Wong et al. (US 7,130,604B1)**, **Balboni (US 6,882,834 B1)**, **Schelmbauer (US 7,138,857)**, **Nguyen et al. (US 2002/0050,861 A1)**, **Kovacevic et al. (US 2003/0216,131 A1)**, **Balteanu (US 6,438,365 B1)**, **Clark et al. (US 6,041,077)**, **Manku et al. (US 6,973,297 B1)**, **Allot et al. (US 2002/0160,738 A1)**, **Marz (US 5,390,346)**, **Kurihara et al. (US 4,394,626)**.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

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Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Charles Chow whose telephone number is (571) 272-7889. The examiner can normally be reached on 8:00am-5:30pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Urban can be reached on (571) 272-7899. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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